allowing said zeolite to settle from said slurry resulting in an upper aqueous fraction and a settled zeolite fraction;

separating said settled zeolite fraction and said upper aqueous suspended fraction; and

mixing said settled zeolite fraction with demineralized water to produce a slurried process stream.

2. The method of Claim 1 wherein the zeolite phase of said zeolite ore comprises one or more of the group consisting of clinoptilolite, mordenite, or other naturally occurring zeolite minerals.

3. The method of Claim 1 wherein the zeolite phase of said zeolite ore is substantially clinoptilolite.

4. The method of Claim 1, wherein preparation of the mechanically preprocessed zeolite ore comprises:

physically liberating the various mineral phases, having a range of respective particle sizes, from the natural mineral ore composition, such that the finest mineral phase to be separated has been effectively liberated from other mineral phases;

controlling the size of said mechanically preprocessed zeolite ore particles to optimize the surface to mass ratio of said particles for said mineral phases to be dispersed and suspended over higher bulk density mineral phases;

controlling the size of zeolite mineral phase to be extracted and purified by selecting the intermediate bulk density of said zeolite mineral phase from the

lower and higher bulk densities of other mineral phases of the ore composition; and

effecting the size of liberated mineral phases comprising:

crushing, grinding, or milling said natural ore, and

screening liberated mineral phases or mechanically separating said liberated mineral phases.

5. The method of Claim 4, wherein the zeolite phase of said zeolite ore comprises one or more of clinoptilolite, mordenite, or other naturally occurring zeolite minerals.

6. The method of Claim 4, wherein the zeolite phase of said zeolite ore is substantially clinoptilolite.

7. The method of Claim 1, additionally comprising:

injecting said slurried process stream into a multistage countercurrent primary separation column at about the midpoint of said primary separation column, said primary separation column having upper, lower and mid-stages;

injecting low electrolyte demineralized water into said lower stage of said primary separation column;

extracting an overflow stream of suspended zeolite from said upper stage of said primary separation column; and

controlling the injection rate of said slurried process stream and said demineralized water into said primary separation column and the extraction rate of said

suspended zeolite such that said demineralized water flows upward at a rate sufficient to suspend said zeolite and such that higher density components of said slurried process stream, having a net settling velocity, flow downward to said lower stage of said primary separation column.

8. The method of Claim 7, wherein the zeolite phase of said zeolite ore comprises one or more of clinoptilolite, mordenite, or other naturally occurring zeolite minerals.

9. The method of Claim 7, wherein the zeolite phase of said zeolite ore is substantially clinoptilolite.

10. The method of Claim 1, wherein forming a slurry, settling the dispersed zeolite phase and removal of the upper aqueous suspended fraction is repeated one or more times.

11. The method of Claim 1, wherein forming a slurry, settling the dispersed zeolite phase and removal of the upper aqueous suspended fraction is either a batch or a semi-continuous process operation.

12. The method of Claim 11, wherein the batch and/or semi-continuous process operation is facilitated, in part, by an electronic process computer device having feedback from said laboratory or process monitoring instruments.

13. The method of Claim 1, additionally comprising:
injecting said suspended zeolite from said primary separation column into a secondary separation column,

said secondary separation column having an upper and lower portions;

injecting low electrolyte demineralized water into said secondary separation column near said lower portion;

extracting a fine particle overflow stream from said upper portion;

controlling the injection rates of said suspended zeolite and said low electrolyte demineralized water into the mid-section of said secondary separation column and the extraction rate of said fine particle overflow stream such that a countercurrent flow is established and that zeolite particles of a desired range of sizes are not carried into said countercurrent flow; and

removing said zeolite particles of a desired range of sizes and bulk density from said lower portion of said secondary separation column wherein the higher bulk density mineral phases or "heavies" are retained.

14. The method of Claim 13, wherein said low electrolyte demineralized water is selected using periodic laboratory bench simulation.

15. The method of Claim 13, wherein the said demineralized water is removed for filtration, polishing demineralization, and recycled for further use in the process, to avoid unwanted water generation and water consumption.

16. The method of Claim 13, wherein the physical and chemical properties of separated said clay phases and heavies phase, or tailings, remain substantially unaltered by the

properties of said low electrolyte demineralized water, to facilitate classification as marketable by-products rather than chemical or hazardous waste products.

17. The method of Claims 13, wherein the chemical state of tailings or by-product mineral phases are not substantially altered.

18. The method of Claim 13, wherein removing zeolite particles from the lower portion of said secondary separation column and controlling the extraction of fine particles in the overflow is achieved by the ratio of said low electrolyte demineralized water injected at the respective locations.

19. The method of Claim 13, wherein the size of fine particles in said overflow are determined by grade sampling or in-line process analysis.

20. The method of Claim 13, wherein the said suspended zeolite from said primary separator column is mechanically reprocessed to further reduce particle size prior to injection into said secondary separator column.

21. The method of Claim 13, wherein the said suspended zeolite from said primary separator column is processed by magnetic devices to further remove magnetic mineral phases prior to injection into said secondary separator column.

22. The method of Claim 19, wherein the fine particle overflow is based, in part, on the analysis of said mineral phases and ratios thereof, by grab sampling or in-line continuous or intermittent analysis using x-ray fluorescence,

laser induced breakdown spectroscopy or alternate methods.

23. The method of Claim 22, wherein the controlled parameters of said low electrolyte demineralized water injection rates and ratio of respective injection flows at each location are achieved by feedback from the analysis of said mineral phases and ratios thereof, and facilitated by an electronic process computer device.

24. The method of Claim 23, wherein the high bulk density, low surface to mass ratio, and minimal propensity of electrical double layer of said heavies mineral phases comprise a state that is not effectively suspended or dispersed by the said low electrolyte demineralized water.

25. The method of Claim 24, wherein the effective separation of said zeolite phase being an intermediate bulk density mineral with respect to said clay phase and said heavies or high bulk density mineral phases, is facilitated.

26. The method of Claim 1, wherein the water volume to said mechanically preprocessed zeolite ore mass ratio is selected by laboratory bench simulation.

27. The method of Claim 1, wherein the demineralized water quality is selected by laboratory bench simulation.

28. The method of Claim 1, wherein the fraction of clay and other low bulk density minerals are periodically assessed by x-ray diffraction, x-ray florescence, or alternate laboratory methods to select the ratio of demineralized water and mechanically preprocessed zeolite ore.

29. The method of Claim 1, wherein the fraction of clay and other low bulk density minerals are continuously or intermittently assessed using in-line process monitoring.

30. The method of Claim 29, wherein the in-line process is an x-ray fluorescence or laser induced breakdown spectroscopy analyzer.

31. The method of Claim 20, wherein the preferred particle size is determined by repeat laboratory simulation for size reduction, further simulation of the extraction and purification and analysis.

32. The method of Claims 1, wherein the low electrolyte demineralized water has a concentration of dissolved minerals that is determined by laboratory or in-line methods of specific ion measurement or by specific conductivity determination.

33. The method of Claim 1, wherein the low electrolyte demineralized water has a concentration of dissolved minerals of about 20 to about 200 ppm.

34. The method of Claim 1, wherein the low electrolyte demineralized water has a concentration of dissolved minerals of about 5 to about 20 ppm.

35. The method of Claim 1, wherein the mean particle size of said mechanically preprocessed ore ranges from about 10 to about 40 microns.

36. The method of Claim 1, wherein the mean particle size of said mechanically preprocessed ore ranges from about 5 to 20

microns.

37. The method of Claim 1, wherein the mean particle size of said mechanically preprocessed ore ranges from about 1 to about 10 microns.

38. The method of Claim 20, wherein the said re-processed particle size of said suspended zeolite ranges from about 5 to about 20 microns.

39. The method of Claim 20, wherein the said re-processed particle size of said suspended zeolite ranges from about 1 to about 5 microns.

40. The method of Claim 1, wherein the said demineralized water is removed for filtration, polishing demineralization, and recycled for further use to avoid unwanted waste generation and water consumption.

41. The method of Claim 1, wherein the volume to mass ratio is determined by continuous or grab sampling, said low electrolyte demineralized water quality.

42. The method of Claim 1, wherein the said effective ratio of said low electrolyte demineralized water to said mechanically preprocessed zeolite ore mass is determined manually or predicted by algorithm residing in an electronic process computer.

43. The method of Claim 1, wherein the said zeolite phase, having physical properties such as bulk density that are greater than that of clay and similar density mineral phases contributes

to a mineral phase separation in said higher purity demineralized water.

44. The method of Claim 1, wherein the surface area to mass ratio of the clay and similar fine particles of other mineral phases being greater than the surface area to mass ratio contributes to a mineral phase separation in said low electrolyte demineralized water.

45. The method of Claim 40, wherein separation of said mineral phases contained in said mechanically preprocessed zeolite ore is attained without contaminating effects of inorganic or organic chemical additives.

46. A process for extracting and purifying natural zeolite from zeolite ore comprising:

hydrating and mechanically dispersing a starting material to separate out highly hydrated clay content; and

separating a zeolite from contaminants having a higher mass to surface area ratio than said zeolite by use of one or more countercurrent flow separation columns in which the dispersing medium is demineralized water.

47. The process of Claim 46, wherein said starting material comprises a pre-processed feedstock.

48. The process of Claim 47, wherein the pre-processed feedstock is prepared by crushing, milling or grinding a feedstock to obtain a desired average or mean particle size.

49. The process of Claim 47, wherein the average or mean particle size of the pre-processed feedstock is about 10 to 40

microns.

50. The process of Claim 46, wherein the zeolite ore comprises one or more of clinoptilolite, mordenite or other naturally occurring zeolite minerals.

51. A process for extracting and purifying natural zeolite from zeolite ore comprising:

pulverizing zeolite ore comprising clinoptilolite, mordenite, feldspar, clay, mica and quartz;

mixing the pulverized ore with demineralized water having less than about 50 ppm electrolytes to form a first slurry;

mixing the first slurry in a batch fashion at high speed;

allowing the first slurry to settle; and

decanting a clay liquid suspension from the settled first slurry to obtain a separated zeolite product.

52. The process of Claim 51, additionally comprising:

adding demineralized water having less than about 50 ppm electrolytes to said separated zeolite product;

mixing the demineralized water and the zeolite product to form a second slurry; injecting said second slurry into the mid-section of a separation column;

delivering demineralized water having less than 50 ppm electrolytes to the lower section of said separation column;

providing a counterflow rate of demineralized water that is sufficient to suspend zeolite and to allow higher density components to settle; and

extracting the suspended zeolite from the settled higher density components.

53. The process of Claim 51, wherein the demineralized water has less than 10 ppm electrolytes.

54. A process for the extraction and purification of zeolite from a zeolite ore comprising:

mixing demineralized water with a settled zeolite fraction to produce a slurried zeolite process stream, said settled zeolite fraction being settled from a mechanically dispersed slurry comprised of demineralized water and a mechanically processed zeolite ore having a mean particle size ranging from about 10 to 40 microns, said slurry having a density of about 5% to 40% and a demineralized water to zeolite ore mass ratio to substantially suspend any clay fraction of said zeolite ore.

55. A process for separation of mineral phases from a natural mineral ore composition, comprising:

separating the mineral phases from an aqueous slurry or suspension by integrating differential suspension and physical separation principles, said aqueous slurry or suspension comprising mineral phases that have been substantially liberated from natural ore by crushing, grinding or milling and demineralized water with low electrolyte content that sustains a maximum electrical double layer to aid dispersal and separation of said mineral phases according to the extent of hydration.

56. A method for classification of a particulate mineral compound comprising:

injecting demineralized water into one or more countercurrent classifying columns comprising an aqueous slurry of the particulate mineral compound to form an ascending demineralized water stream sufficient to amplify differences in particle settling velocity.

57. The method of Claim 56, wherein the one or more classifying columns each have one or more stages, a feed injection port at about the midpoint of said classifying column, a demineralized water injection port below said feed injection port, a cap at such column's topmost edge, and an overflow port below said cap.

58. The method of Claim 56, wherein the number, size and/or configuration of the one or more countercurrent classifying columns is tailored to a desired particle size and/or mineral phase.

59. The method of Claim 56, wherein the aqueous slurry in the countercurrent classifying column has a slurry density of about 5% to about 40%.

60. The method of Claim 56, wherein the particulate mineral compound comprises particles possessing an electrical double layer when hydrated in low electrolyte medium and having a range of particle sizes.

61. The method of Claim 56, wherein said particulate

mineral compound is a compound comprising particles of a desired range of sizes from a lower portion of a secondary separation column.

62. The method of Claim 56, wherein the particulate mineral compound is a zeolite compound.

63. The method of Claim 56, wherein the aqueous slurry has a slurry density of 10% to 20%.

64. The method of Claim 56, wherein the demineralized water has a low electrolyte content.

65. The method of Claim 56, wherein the demineralized water has an electrolyte content of less than about 500 ppm.

66. The method of Claim 56, wherein the demineralized water has an electrolyte content of less than about 100 ppm.

67. The method of Claim 56, wherein the demineralized water has an electrolyte content of less than about 50 ppm.

68. The method of Claim 56, wherein the demineralized water has an electrolyte content of less than about 10 ppm.

69. A method for classification of a particulate mineral compound comprising:

introducing an aqueous slurry of said particulate mineral compound slurry into a countercurrent classifying column, said classifying column having one or more stages, a feed injection port at about the midpoint of said classifying column, a demineralized water

injection port below said feed injection port, a cap at such column's topmost edge, and an overflow port below said cap;

injecting demineralized water into said countercurrent classifying column at said demineralized water injection port so as to form an ascending demineralized water stream sufficient to amplify differences in particle settling velocity;

separating said particulate compound using the separation effect of said electrical double layer; and

extracting an overflow stream through said overflow port.

70. The method of Claim 69, wherein said particulate mineral compound is a compound comprising particles of a desired range of sizes from a lower portion of a secondary separation column.

71. The method of Claim 69, wherein the particulate mineral compound is a zeolite compound.

72. The method of Claim 69, wherein the aqueous slurry in the countercurrent classifying column has a slurry density of about 5% to about 40%.

73. The method of Claim 69, wherein the aqueous slurry in the countercurrent classifying column has a slurry density of about 10% to about 20%.

74. The method of Claim 69, wherein the demineralized water has a low electrolyte content.

75. The method of Claim 69, wherein the demineralized

water has an electrolyte content of less than about 500 ppm.

76. The method of Claim 69, wherein the demineralized water has an electrolyte content of less than about 100 ppm.

77. The method of Claim 70, wherein the demineralized water has an electrolyte content of less than about 50 ppm.

78. The method of Claim 71, wherein the demineralized water has an electrolyte content of less than about 10 ppm.

79. A method for classification of a particulate mineral compound comprising:

injecting a slurried process stream into a multistage countercurrent primary separation column at about the midpoint of said primary separation column, said primary separation column having upper, lower and mid-stages;

injecting demineralized water into said lower stage of said primary separation column;

extracting an overflow stream of suspended particulate mineral compound from said upper stage of said primary separation column; and

controlling the injection rate of said slurried process stream and said demineralized water into said primary separation column and the extraction rate of said suspended particulate mineral compound such that said demineralized water flows upward at a rate sufficient to suspend said particulate compound and such that higher density components of said slurried process

stream, having a net settling velocity, flow downward to said lower stage of said primary separation column.

80. The method of Claim 79, additionally comprising:

injecting said suspended particulate mineral compound from said primary separation column into a secondary separation column, said secondary separation column having upper and lower portions;

injecting demineralized water into said secondary separation column near said lower portion;

extracting a fine particle overflow stream from said upper portion;

controlling the injection rates of said suspended particulate mineral compound and said demineralized water into said secondary separation column and the extraction rate of said fine particle overflow stream such that a countercurrent flow is established and that particles of said particulate mineral compound of a desired range of sizes are not carried into said countercurrent flow; and

removing said particles of a desired range of sizes from said lower portion of said secondary separation column.

81. A process for the extraction and purification of zeolite from a zeolite ore containing other mineral phases comprising:

preparing a slurry consisting of demineralized water and zeolite ore having a mean particle size ranging from about 10 to 40 microns, said slurry having a density

of about 5% to 40%, said slurry having a demineralized water to zeolite ore mass ratio sufficient to substantially suspend ;

subjecting said slurry to mechanical dispersion having a demineralized water to zeolite ore mass ratio to substantially suspend any clay fraction of said zeolite ore;

allowing said zeolite to settle from said slurry resulting in an upper aqueous fraction and a settled zeolite fraction;

separating said settled zeolite fraction and said upper aqueous fraction; and

mixing said settled zeolite fraction with demineralized water to produce a slurried process stream.

82. The process of Claim 81, further comprising the steps of:

injecting said slurried process stream into a multistage countercurrent primary separation column at about the midpoint of said primary separation column, said primary separation column having upper, lower and mid-stages;

injecting demineralized water into said lower stage of said primary separation column;

extracting an overflow stream of suspended zeolite from said upper stage of said primary separation column; and

controlling the injection rate of said slurried process stream and said demineralized water into said primary

separation column and the extraction rate of said suspended zeolite such that said demineralized water flows upward at a rate sufficient to suspend said zeolite and such that higher density components of said slurried process stream, having a net settling velocity, flow downward to said lower stage of said primary separation column.

83. The process of Claim 81, further comprising the steps of:

injecting said suspended zeolite from said primary separation column into a secondary separation column, said secondary separation column having upper and lower portions;

injecting demineralized water into said secondary separation column near said lower portion;

extracting a fine particle overflow stream from said upper portion;

controlling the injection rates of said suspended zeolite and said demineralized water into said secondary separation column and the extraction rate of said fine particle overflow stream such that a countercurrent flow is established and that zeolite particles of a desired range of sizes are not carried into said countercurrent flow; and

removing said zeolite particles of a desired range of sizes from said lower portion of said secondary separation column.

84. The process of Claim 81, wherein the zeolite phase of said zeolite ore is substantially clinoptilolite.

85. The process of Claim 82, wherein the zeolite phase of said zeolite ore is substantially clinoptilolite.

86. The process of Claim 83, wherein the zeolite phase of said zeolite ore is substantially clinoptilolite.

87. The process of Claim 81, wherein the zeolite phase of said zeolite ore comprises one or more of the group consisting of clinoptilolite, mordenite, or other naturally occurring zeolite minerals.

88. The process of Claim 82, wherein the zeolite phase of said zeolite ore comprises one or more of the group consisting of clinoptilolite, mordenite, or other naturally occurring zeolite minerals.

89. The process of Claim 83, wherein the zeolite phase of said zeolite ore comprises one or more of the group consisting of clinoptilolite, mordenite, or other naturally occurring zeolite minerals.

90. A method for separation of mineral phases from a natural mineral ore composition, said mineral phases having inherent variations in hydration properties, and resulting in differential suspension in a aqueous slurry or suspension, comprising:

crushing, grinding, or milling said natural ore to substantially liberate said mineral phases;

preparing an aqueous slurry or suspension in demineralized

water wherein the low electrolyte content sustains a maximum electrical double layer to aid dispersal and separation of said mineral phases according to extent of hydration; and

separating said mineral phases by integrating the effect of differential suspension and physical separation principles.

91. A composition prepared by a process comprising:

preparing an aqueous slurry of said particulate mineral compound, said aqueous slurry having a slurry density of 5% to 40%;

introducing said slurry into a countercurrent classifying column, said classifying column having one or more stages, a feed injection port at about the midpoint of said classifying column, a demineralized water injection port below said feed injection port, a cap at such column's topmost edge, and an overflow port below said cap;

introducing demineralized water into said countercurrent classifying column at said demineralized water injection port to form an ascending demineralized water stream;

separating said particulate compound using the separation effect of said electrical double layer; and

extracting an overflow stream through said overflow port.

92. A composition prepared by a process comprising:

preparing a slurry consisting of demineralized water and zeolite ore having a mean particle size ranging from about 10 to 40 microns, said slurry having a density of about 5% to 40%, said slurry having a demineralized water to zeolite ore mass ratio sufficient to substantially suspend ;

subjecting said slurry to mechanical dispersion having a demineralized water to zeolite ore mass ratio to substantially suspend any clay fraction of said zeolite ore;

allowing said zeolite to settle from said slurry resulting in an upper aqueous fraction and a settled zeolite fraction;

separating said settled zeolite fraction and said upper aqueous fraction; and

mixing said settled zeolite fraction with demineralized water to produce a slurried process stream.

93. A composition prepared by a process comprising:

crushing, grinding, or milling a natural mineral ore to liberate mineral phases that have inherent variations in hydration properties;

preparing an aqueous slurry or suspension of the natural mineral ore in demineralized water wherein the low electrolyte content sustains a maximum electrical double layer to aid dispersal and separation of mineral phases in the natural mineral ore according to extent of hydration; and

separating said mineral phases by integrating the effect of differential suspension and physical separation principles.

CONCLUSION

To the extent that any further fees, whatsoever, are required at any time during the prosecution of this application, including any petition and extension fees, the Commissioner is hereby authorized to charge payment of any additional fees, including, without limitation, any fees under 37 C.F.R. § 1.16 or 37 C.F.R. § 1.17, to Deposit Account No. 23-3189 of Hunton & Williams (Dallas) and reference Attorney Docket No. 88742.71. Please credit any overpayments to this same Deposit Account.

Respectfully submitted,

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